MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2022/2023

BMF1014 – MATHEMATICS FOR FINANCE

(All sections / Groups)

10 JULY 2023
9.00 a.m. – 11.00 a.m.
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This question paper consists of **SIX (6)** printed pages with 4 questions only, excluding the cover page.

2. Attempt **ALL FOUR (4)** questions.

3. Write all your answers in the Answer Booklet provided. All necessary workings **MUST** be shown.

4. The mathematical formula sheet is attached at the end of this question paper.

Question 1 (25 marks)

(a) Elegance Dress is a retailer of trendy dresses and has a monthly fixed cost of RM28800. The cost of producing a dress is RM80 and it sells for RM130. Use the information given to

(i) find the cost function,

[2 marks]

(ii) find the revenue function,

[2 marks]

(iii) compute the profit from selling 632 dresses,

[4 marks]

(iv) compute the break-even quantity.

[5 marks]

(b) Sam invested RM5000 in a bank for four and a half years and earned a simple interest of RM950. Compute the interest rate.

[3 marks]

(c) Compute the effective rate of interest corresponding to a nominal rate of 7.54% per year compounded monthly.

[3 marks]

(d) In 12 years, a RM53000 machine will have a salvage value of RM8000. A new machine at that time is expected to sell for RM72000. To provide funds for the difference between the replacement cost and the salvage value, a sinking fund is set up into which equal payments are placed at the end of each year. Compute the payment size if the fund earns 6% compounded annually.

[6 marks]

Question 2 (25 marks)

(a) If $\mathbf{A}=\begin{bmatrix} 4 & 1 \\ 0 & -2 \\ 5 & 3 \end{bmatrix}$, $\mathbf{B}=\begin{bmatrix} 1 & 0 & 4 \\ 6 & -3 & 2 \end{bmatrix}$ and $\mathbf{C}=\begin{bmatrix} 9 & 3 \\ -1 & 2 \\ 7 & 5 \end{bmatrix}$,

(i) compute $5\mathbf{A}+7\mathbf{C}$.

[5 marks]

(ii) compute $\mathbf{AB}$.

[3 marks]

Continued...

(b) Consider the following system of equations:

$$2x+2y+3z=10$$
$$4x-y+z=-5$$
$$5x-2y+6z=1$$

(i) Write the system of equation above in a form, $\boldsymbol{Ax} = \boldsymbol{B}$. **[3 marks]**

(ii) Find the determinant, minor and the inverse of matrix A. **[11 marks]**

(iii) Find value of x, y and z. **[3 marks]**

Question 3 (25 marks)

(a) The market research department of Trans Corporation recommends that the company manufactures and markets a new transistor radio. After suitable test marketing, the research department presents the following demand equation which as follows:

$$p=10-0.001x$$

Ringgit Malaysia, where x is the number of radios retailers are likely to buy. The financial department provides the following cost function:

$$C(x)=2x+7000.$$

(i) Find the marginal cost function. **[2 marks]**

(ii) Compute the marginal revenue at $x=2100$. **[6 marks]**

(iii) Compute the marginal profit at $x=1350$. **[6 marks]**

(b) If $4x^2-5x^3y^2=y-6x+1$, find $\frac{dy}{dx}$. **[6 marks]**

(c) Evaluate the following integral:

$$\int_2^4 \left(2e^x+3\sqrt{x}-7\right) dx.$$

[5 marks]

Continued...

Question 4 (25 marks)

(a) The monthly profit (in Ringgit Malaysia) of Variety Department Store depends on the level of inventory x (in thousands of Ringgit Malaysia) and the floor space, y (in thousands of square feet) available for display of the merchandise, as given by the following function:

$$P(x,y) = -0.03x^2 - 20y^2 + 2xy + 30x + 25y - 25000$$

Compute the first partial derivatives of the function $P(x,y)$ when $x = 4200$ and $y = 200$. Interpret your results.

[11 marks]

(b) Find the second-order partial derivatives for the following function. Next compute $z_{xx}(3,5)$.

$$z = 2x^2y^2 - 3x^3y + 15x - 18y + 2$$

[14 marks]

End of Questions.

Subject Code: BMF1014
Subject Name: Mathematics for Finance

Summary of Principal Formulas and Terms

1. Quadratic Formula

The solution of the equation: $ax^2 + bx + c = 0$ where $a \neq 0$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

2. Simple Interest

(i) Interest, $I = Prt$ (P = principal, r = interest rate, t = number of years)
(ii) Accumulated amount, $A = P(1 + rt)$

3. Compound Interest

(i) Accumulated amount, $A = P(1+i)^n$, where $i = \frac{r}{m}$, and $n = mt$

(m = number of conversion periods per year)

(ii) Present value for compound interest, $P = A(1+i)^{-n}$

4. Effective Rate of Interest

$$r_{eff} = \left[1 + \frac{r}{m}\right]^m - 1$$

5. Future Value of an Annuity

$$S = R\left[\frac{(1+i)^n - 1}{i}\right]$$

(S = future value of ordinary annuity of n payments of R periodic payment)

6. Present Value of an Annuity

$$P = R\left[\frac{1-(1+i)^{-n}}{i}\right]$$

(P = present value of ordinary annuity of n payments of R periodic payment)

7. Amortization Formula

$$R = \frac{Pi}{1-(1+i)^{-n}}$$

(R = periodic payment on a loan of P to be amortized over n periods)

Continued...

8. Sinking Fund Formula

$$R = \frac{Si}{(1+i)^n - 1}$$

(R = periodic payment required to accumulate S over n periods)

9. Basic Rules of Differentiation

(a) Derivative of a constant: If $f(x)$ is a constant, then $f'(x) = 0$

(b) Power rule : If $f(x)$ is x^n, then $f'(x) = nx^{n-1}$

(c) Constant multiple rule: $\frac{d}{dx}[cf(x)] = cf'(x)$ (c is a constant)

(d) Sum rule: $\frac{d}{dx}[f(x) \pm g(x)] = f'(x) \pm g'(x)$

(e) Product rule: If $f(x) = u(x) \cdot v(x)$, then $f'(x) = u(x)v'(x) + v(x)u'(x)$

(f) Quotient rule: $f'(x) = \frac{d}{dx}\left[\frac{u(x)}{v(x)}\right] = \frac{v(x)u'(x) - u(x)v'(x)}{[v(x)]^2}$

(g) Chain rule: $\frac{dy}{dx} = \frac{dy}{du} \times \frac{du}{dx}$

(h) General power rule: $\frac{d}{dx}[f(x)]^n = n[f(x)]^{n-1} f'(x)$

(i) Exponential function: $\frac{d}{dx}(e^x) = e^x$

$\frac{d}{dx}(e^{f(x)}) = e^{f(x)}[f'(x)]$

(j) Logarithmic function: $\frac{d}{dx}(\ln x) = \left(\frac{1}{x}\right)$

$\frac{d}{dx}(\ln f(x)) = \frac{f'(x)}{f(x)}$

10. Basic Rules of Integration

(a) Indefinite integral of a constant: $\int k \, dx = kx + C$

(b) Power rule: $\int x^n dx = \frac{x^{n+1}}{n+1} + C$

(c) Constant multiple rule: $\int kf(x) \, dx = k\int f(x) \, dx$ where k is a constant

(d) Sum rule: $\int [f(x) \pm g(x)] \, dx = \int f(x)dx + \int g(x)dx$

Continued...

(e) Exponential function: $\int e^{x} dx = e^{x} + C$

(f) Logarithmic function: $\int \left(\frac{1}{x}\right) dx = \ln x + C$

11. Determining Relative Extremas

$D(x, y) = f_{xx} f_{yy} - \left(f_{xy}\right)^2$

If $D > 0$ and $f_{xx} > 0$, relative minimum point occurs at (x, y).
If $D > 0$ and $f_{xx} < 0$, relative maximum point occurs at (x, y).
If $D < 0$, (x, y) is neither maximum nor minimum.
If $D = 0$, the test is inconclusive.

End of Page.